ABSTRACT: An automatic let-off mechanism for looms wherein a part, at least, of the loom backrest is movable sensitive to tension in the warp sheet, the displacement not being appreciable, and the tension applied to such part by the warp yarn is detected by a force transducer and after suitable amplification, the signal is used to control the feed of warp yarn in either the forward or reverse sense.
LOOM WARP LETTING-OFF MECHANISM

This invention relates to automatic warp letting-off mechanisms for weaving looms, and has particular, but not exclusive, application to heavy looms of relatively wide reed space, such as those required for weaving papermakers’ felts and the like.

In various known mechanisms it is common practice to mount the entire backrest so as to be displacably sensitive to the tension and/or length of the warp yarn bearing on it. In the case of medium and wide looms, however, such provision is unnecessarily cumbersome and costly, and is also inconvenient in use.

According to the present invention at least a part of the backrest is arranged so as to be sensitive to, but not appreciably displaced by, the tension of the warp yarn bearing on it, and the mechanism includes means whereby the feed of warp yarn is altered depending upon whether its tension, as sensed by the backrest, is greater or less than the pre-set normal tension.

The preferred sensitive part is a comparatively short section of the loom’s backrest, such short section being hereinafter referred to as “A Sampling Backrest,” because it is sensitive to the tension of a representative part or sample of the full-width warp. This sampling backrest is flexibly mounted on the loom structure near to or actually in the middle of the loom’s weaving width, whereas the remainder of the backrest is rigidly and immovably fixed to that structure.

The warp yarn unwinding from the beam preferably first laps partly around a tension bar, then reverses to lap around a backrest tube to the extent of 160° or more, and thence extends horizontally through the healds and reed to the fell of the cloth.

According to a preferred feature of this invention, the sampling backrest is carried on two vertical levers pivoted on the loom structure, which levers are extended into arms having end-pads adapted to bear on two load cells, or force transducers, rigidly mounted on the loom structure.

The said load cells, which are subjected to the varying substantially horizontal load imposed by the warp yarn on the sampling backrest during each weaving cycle, produce comparative variations of electric potential which, after amplification in known manner, are used to control the warp supply.

The sampling backrest is thus virtually in constant alignment with the remainder of the fixed backrest as the displacement of the load cells, and therefore of sampling backrest, is quite significant with regard to the elasticity of the warp yarn and the generally accepted tensional irregularities inseparable from warp drawn from a beam. An important practical advantage of this arrangement is that, as there is no displacement, it is not necessary to provide any mechanism for locking the sampling backrest during the beat-up. It follows that the length, and therefore the tension, of the warp yarn bearing respectively on the sampling backrest and on the fixed remainder of the backrest are equal and remain so throughout the weaving process.

According to another feature of the invention, an electric timing switch driven at loom crankshaft speed is arranged to disconnect the said sensing means from the let-off mechanism it controls just prior to the beat-up and to reconnect them just after that operation, whereby the tension of the warp during the weaving cycle, otherwise than at the beat-up, controls the responsive action of the let-off mechanism.

The amplified output of the load cells serves to energise, or not, two electric contactors, of which No. 1 contactor is arranged to close a circuit when the warp tension exceeds the appropriately adjusted normal tension, and to open circuit when that tension is attained, whereas the remainder of the backrest is arranged to close a circuit when the warp tension is less than the said normal tension, and to open such circuit when that tension is again attained. A manual adjustment is provided whereby the normal tension of the warp yarn can be pre-set over a wide range to suit the fabric to be woven.

Either or both the aforesaid electric contactors may be used to control the supply of warp yarn in any convenient manner, but it is preferred to combine the said improved warp tension sensing means with the motorised warp let-off mechanism described in the specification of our co-pending U.S. application of Thomas Hindle, Ser. No. 675,817, filed October 17, 1967, now U.S. Pat. No. 3,498,337, wherein the beam, or the rest of friction rolls in the particular case of creel-weaving, is intermittently driven through suitable reduction gearing, preferably including change-gears, by an electric motor equipped with an electro-magnetically released brake.

In normal operation, by reason of the temporary excess of warp tension as and when the timing switch closes just after the beat-up in every crankshaft revolution, No. 1 contactor closes and the motor starts up and rotates the beam to release more warp yarn. It then runs for a variable period dependent upon the length of warp yarn needed to be let-off in order to restore the warp to its normal tension. The motor is stopped by No. 1 contactor opening circuit when the normal tension is attained, or in the extreme case, by the timing switch opening circuit just before the next beat-up operation. If, however, the warp yarn becomes slack, so that its tension is less than the pre-set normal tension, as may arise when starting-up a new warp or during the process of unwinding to remedy a weaving fault, No. 2 contactor is energised and causes the motor to start-up in the reverse direction, so as to wind back the surplus warp on to the beam. The motor stops when the said contactor is de-energised upon the normal tension being attained.

In the particular case of creel weaving, the rest of friction rolls used to control the warp yarn, is likewise driven in the reverse direction, the surplus warp then being temporarily absorbed by a system of faller bars.

An instrument of known construction may be connected to the amplified voltage output of the said load cells to indicate or record the warp tension during weaving.

The invention will now be further described by way of example only with reference to the following diagrammatic drawings in which:

FIG. 1 is a cross-section through the rear part of a loom, showing the sampling backrest and the load-cells in relation to the warp-beam; and

FIG. 2 is a plan view showing the sampling backrest and the load-cells, and (in diagram form) the amplifier with manual tension adjustment, the timing-switch and the contractors which energise the motor and brake.

Referring to FIGS. 1 and 2, a warp yarn W, released from a warp beam 1, preferably first laps partly around a friction bar 2, then reverses to lap around the backrest tube 3 to the extent of 160° or more, and thence extends horizontally through the healds 4 and reed (not shown) to the fell of the cloth in the usual manner. In some cases, the warp yarn may pass direct from the beam to the backrest as indicated at X.

The sampling backrest 3 is carried on two vertical levers 5 pivoted at 6 on the loom structure 10. The said levers are extended into horizontal arms 7 having end-pads 8 adapted to bear on two load-cells 9 likewise supported on the loom structure 10. The sampling backrest 3 is located approximately midway in the width of the loom, while the end sections F, F, of the backrest are rigidly and immovably fixed to the loom structure 10.

The electrical indications of the load imposed by the warp yarn on the sampling backrest emanating from the load-cells are suitably amplified in the amplifier 11, (FIG. 2) which is provided with a manual adjustment 12 by which the normal tension of the warp yarn is pre-set to suit the requirements of the fabric to be woven. The amplifier is arranged, in known manner, to control the two contactors 14, and 15, which cause the while No. 2 contactor 15 to rotate in either direction so as to unwind warp from the beam 1, or to rewind surplus warp yarn back on the beam, as necessary to maintain the warp yarn at the adjusted normal tension. The motor 16 is provided with a brake 17, which is spring-applied and released when the motor is energised.
Included in the circuitry is the timing-switch 18, which is operated by a cam on the loom crankshaft, or equivalent, the switch being arranged to open circuit shortly before the weft is beaten-up, and to close circuit shortly thereafter, so that the peak beat-up tension does not control or influence the rate of warp let-off.

The motor 16 is geared to the warp beam 1, the reduction gearing (not shown) preferably including change-gears. In the particular case of creel-weaving, the motor is geared to the nest of friction rolls which replace the beam and control the warp yarn between creel and backrest.

The invention is not restricted to the exact feature of the embodiment described since alternatives will present themselves to one skilled in the art. Thus, for example, the backrest may bear directly upon the load-cells rather than contact such load-cells through a bell-crank lever of the kind hereinbefore described.

We claim:

1. A textile loom of the kind wherein yarns pass from a warp beam over a backrest on their way from the beam to the shed, a motor connected to the beam for effecting rotation thereof, an electric circuit provided for controlling the operation of the motor and a backrest comprising fixed and movable parts; means supporting the movable part of the backrest in alignment with the fixed part thereof, said means being operable by deflection, which is negligible in comparison to the elasticity and/or accepted irregularities in the yarn in response to a change in tension in the yarn from a predetermined normal tension, to activate the electrical circuit and to cause the motor to rotate the beam in a direction determined by the deviation of the sensed tension from the preset tension.

2. Apparatus according to claim 1 wherein said means comprise a transducer in the electric circuit operable according to the load applied thereto by a change in tension in the yarns to effect operation of the motor.

3. Apparatus according to claim 1 wherein said means comprise pressure-responsive transducers in the electric circuit operable according to a change in tension in the yarns to effect operation of the motor and lever arms fixed at one end to the movable part of the backrest with their other ends bearing upon the transducers, said arms being operable by a change in load applied to the movable part of the backrest to change the load upon the transducers.

4. Apparatus according to claim 1 wherein said means comprise transducers in the electric circuit and there are switch means in the electric circuit operable to disable the transducers during the period of beat-up.

5. Apparatus according to claim 1 wherein said means comprise transducers in the electric circuit and there are switch means in the electric circuit operable in one position in response to the transducers to effect operation of the motor in a direction to feed yarn until said predetermined tension is restored and then to open the circuit and in another position in response to the transducers to effect operation of the motor in a direction to take up yarn until such predetermined tension is restored and then open the circuit.